THE INFLUENCE OF COVER CROP CULTIVATION ON POPULATIONS OF INJURIOUS INSECTS AND MITES IN FLORIDA CITRUS GROVES [1]

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Cultural practices involving the natural ground cover or cover crop vary considerably from area to area and grove to grove in Florida. This variation is, in some instances, governed by the level of the water table or the type of soil involved. More frequently, however, cultivation is modified by the opinions of the grower. Some growers maintain weed-free groves by frequent disking, harrowing or chopping. Others permit cover crop development during the summer months but practice clean cultivation in the fall, winter and spring. Still others allow weeds and wild grasses to grow unhampered from one picking season to the next. Horticultural and agronomic reasons cited for such variations in practices include moisture conservation, soil conservation, fire protection, soil protection, tree stimulation and efficient grove management. Furthermore, many growers believe that such practices cause increases or decreases in insect and mite abundance.

To date only two studies have been conducted on the influence of cover crop cultivation on insect and mite infestations. The first was an investigation by Osburn and Mathis (1944) concerning the citrus rust mite, *Phyllocoptruta oleivora* (Ashmead). These workers concluded that there was no difference between rust mite infestations on trees in clean cultivated plots and on trees grown in plots having a cover crop. They did, however, record stimulation of the trees in the clean cultivation plots. Two years later the same workers (Osburn and Mathis, 1946) reported markedly greater infestations of Florida red scale, *Chrysomphalus aonidum* (L.), on trees growing in cultivated plots than on trees in uncultivated plots. They were unable, however, to demonstrate striking differences in the percentages of parasitized scales or fungi-affected scales and concluded that tree stimulation, a result of cultivation, was the important factor in the development of larger scale infestations.

The present study was conducted to obtain preliminary cultivation data on the major injurious insects and mites attacking Florida citrus and to correlate, if possible, any differences recorded with changes in the rates of parasitism or predation.

EXPERIMENTAL PROCEDURE

PLOT DESIGN.—This study of the effects of cover crop cultivation on insect and mite populations was based on three grove experiments: one on the east coast at Fort Pierce, one on the west coast at Tarpon Springs, and one in the north at Weirsdale. A fourth grove located in the central district at Dundee had to be abandoned after the first year because of an infestation of burrowing nematode. The experiment was conducted for six years at Fort Pierce, five years at Weirsdale, and four years at Tarpon Springs. Each grove was divided into three approximately equal sections. At Fort Pierce, the sections were about ten acres in size, at Weirsdale about seven acres and at Tarpon Springs about three. One section was cultivated frequently to keep cover crop growth to a minimum (over cultivated), one section was cultivated as infrequently as was practical (under cultivated), and the third section was occasionally cultivated at the discretion of the grove owner (moderately cultivated). Several types of cultivation were employed: the grove at Fort Pierce was ridged, the ditches were plowed out and disked down in the spring and the cover crop was mowed and vines hooked out of the trees in the summer, fall, and winter. Cultivation practices at Weirsdale included spring plowing and disking, and sum-

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mer, fall and winter chopping. At Tarpon Springs the cover crop was disked in the spring and harrowed in the summer, fall and winter. The Fort Pierce grove was sulfur-dusted except during 1957 and 1958, the Weirsdale grove was untreated, and the Tarpon Springs grove was sprayed regularly.

COUNT METHODS.—Each plot was sampled monthly and population counts were made in the laboratory with a dissecting microscope. Each sample consisted of 20 inside and 20 outside leaves collected from four trees. Adult female host insects and mites were counted on the total surface of each leaf in most instances as it was felt that this stage, the final egg producing stage of a generation, best exemplified the population trend. Citrus rust mites, however, were counted in four lens fields to the leaf while six-spotted mite and citrus flat mite populations were based on total number of moving mites per sample. All feeding stages of predators and all stages of parasites were counted.

EVALUATION METHODS.—Resultant count data were evaluated with population trend-line graphs, yearly total and mean population tables, hosts per natural control factor comparisons, and percent parasitism figures. The results, discussed and tabulated below, were obtained by analyses with two or more of these methods.

"Grove years," referred to in the text and tables represents an accumulation of years and groves into a single total figure. For example purple scale was found in every grove during every year, "15 grove years."

RESULTS

When the accumulated data were analyzed it was discovered that moderate cultivation produced results that varied from year to year, season to season, month to month, and grove to grove. Therefore, the following discussions are based entirely on the over and under cultivated plots.

PURPLE SCALE, LEPIDOSAPHES BECKII (NEWM.).—Populations of this insect exhibited a remarkably consistent reaction to cultivation. For 11 of the 15 grove years, populations were slightly to strikingly lower in under cultivated plots. The following exceptions occurred during the remaining four years: there was no difference in one year at Fort Pierce, but populations were slightly lower in over cultivated plots for two years at Fort Pierce and one year at Palm Harbor. Mean populations of this insect over the entire experimental period are shown in Table 1.

Analyses of predator and parasite data were made in an effort to determine the cause of lower populations in under cultivated plots. It was found that the common fungus disease, chytridiosis, was consistently host-density dependent, causing the least mortality in the lower scale populations in the under cultivated plots. Parasitism of young female scales by *Aspidiotiphagus* spp. and of mature female scales by *Aphytis lepidosaphes* Compere was not, on the other hand, consistently higher in either under or over cultivated plots. Also, no consistent relationship between scale populations and populations of the predatory thrips, *Aleurodothrips fasciapennis* Franklin, existed in the data. Summary figures of these relationships are given in Table 3.

FLORIDA RED SCALE, CHRYSOMPHALUS AONIDUM (L.).—Populations of this scale were very low (Table 1). It is interesting to note, however, that

TABLE. 1.—Scale Insect Populations in Experimental Groves Wherein the Cover Crop Was Over or Under Cultivated from May, 1954, to December, 1959.

Scale Species	Grove Years Sampled	Mean No. Adult Females per 40-Leaf Sample					
		Ft. Pierce Grove		Weirsdale Grove		Palm Harbor Grove	
		Over	Under	Over	Under	Over	Under
Purple Scale *Lepidosaphes beckii* (Newm.)	15	26.7	15.2	25.1	14.7	78.3	70.7
Florida Red Scale *Chrysomphalus aonidum* (L.)	15	1.2	1.1	0.7	0.4	1.2	0.1
Chaff Scale *Parlatoria pergandii* Comst.	14	8.7	2.2	2.0	1.5	1.8	0.7
Glover's Scale *Lepidosaphes gloveri* (Pack.)	5	0.8	1.1	2.5	3.7	0.02	0.08
Yellow Scale *Aonidiella citrina* (Coq.)	4	—	—	—	—	3.6	1.5

lower populations of this insect occurred in the under cultivated plots. For nine of the 15 grove years, populations were lower in the under cultivated plots, for two years they were equal in the under and over cultivated plots, and for four years lower in the over cultivated plots. Mean populations are summarized in Table 1. These results parallel those of Osburn and Mathis (1946).

Counts were made on the only two natural control factors known to cause heavy mortality of this insect, one the critical parasite *Pseudhomalopoda prima* Gir., the other a complex of parasitic wasps that attacks immature scales. No consistent relationship was found to exist between *Pseudhomalopoda* and Florida red scale (Table 3). Although the figures are not included here, the same was true with the parasite complex attacking immature scales.

Chaff Scale, Parlatoria pergandii Comst.—This scale occurred in the test plots 14 out of 15 grove years. Mean population figures given in Table 1 show that populations were lower in under cultivated plots. Yearly data exhibited a high degree of consistency, with populations lower in the under cultivated plots in thirteen years and equal one year.

Evaluation of a complex of *Prospaltella fasciata* Mal. and *Aphytis hispanicus* Mercet indicated that parasitism was higher in under cultivated plots (Table 3). The consistency of this phenomenon was, however, somewhat less than that exhibited by the scale population.

Glover's Scale, Lepidosaphes gloveri (Pack).—This scale was counted only five grove years, but populations were lower in over cultivated plots in four of the five years and equal in one year (Table 1).

The common parasite, *Prospaltella elongata* Doz., was not consistently associated with the lower populations (Table 3).

Yellow Scale, Aonidiella citrina (Coq.).—This potentially important scale insect occurred in significant numbers only in the Palm Harbor grove. Mean population data for four years indicate strikingly lower populations in the under cultivated plot (Table 1). This phenomenon occurred every year.

Although the common parasite, *Aphytis chrysomphali* (Mercet), was not consistently more numerous in the under cultivated plot, trend-line graphs demonstrated a consistent parasite lag phenomenon. This indicated that the parasite was probably the controlling factor and was somewhat density independent during the test period. The number of scales per parasite given in Table 3 also indicated a certain degree of density independency.

Citrus Rust Mite, Phyllocoptruta oleivora (Ashm.).—Populations of this mite did not react to intensity of cultivation. Although the summary data given in Table 2 indicated that populations might be lower in over cultivated plots, analyses of yearly means and trend line graphs showed no consistency. These data agree with the findings of Osburn and Mathis (1944).

Although no data are presented here, the incidence of *Hirsutella thompsonii* Fisher was consistently higher in the heavier populations, indicating a strong host-density dependency.

Citrus Red Mite, Panonychus citri (McG.).—This spider mite was not present in large numbers except at Fort Pierce during 1954. Populations were lowest in under cultivated plots, but the data were not strikingly

TABLE. 2.—Mite Populations in Experimental Groves Wherein the Cover Crop was Over or Under Cultivated from May, 1954, to December, 1959.

Mite Species	Grove Years Sampled	Mean No. Mites per 40-Leaf Sample *					
		Ft. Pierce Grove		Weirsdale Grove		Palm Harbor Grove	
		Over	Under	Over	Under	Over	Under
Citrus Rust Mite *Phyllocoptruta oleivora* (Ashm.)	15	99.5	122.8	123.0	143.0	3.8	1.0
Citrus Red Mite *Panonychus citri* (McG.)	10	8.3	7.4	—	—	3.0	2.4
Texas Citrus Mite *Eutetranychus banksi* (McG.)	7	0.0	1.3	2.1	2.8	0.5	6.4
Six-spotted Mite *Eotetranychus sexmaculatus* (Riley)	8	—	—	8.5	5.8	4.1	1.3
Citrus Flat Mite *Brevipalpus phoenecis* (Gjks.)	6	43.6	86.1	—	—	—	—

* Mite counts were made as follows: Citrus rust mite—no. mites in 4 lens fields per leaf; citrus red mite—no. adult females; Texas citrus mite—no. adult females; Six-spotted mites—total of all stages except eggs; citrus flat mite—total of all stages except eggs.

TABLE 3.—Number of Host Insects and Mites per Predator, Parasite or Disease in Experimental Groves Wherein the Cover Crop was Over or Under Cultivated from May, 1954, to December, 1959.

Ratio	Grove Years Sampled	No. of Hosts per Predator, Parasite or Disease					
		Ft. Pierce Grove		Weirsdale Grove		Palm Harbor Grove	
		Over	Under	Over	Under	Over	Under
Purple Scale/Chytrid	15	13.3	42.9	45.2	50.1	5.2	7.1
Purple Scale/*Aspidiotiphagus*	15	36.4	39.9	21.3	15.4	1.0	1.2
Purple Scale/*Aphytis*	6	0.4	0.3	2.1	1.7	1.1	1.4
Purple Scale/*Aleurodothrips*	15	20.6	37.1	19.0	9.0	25.7	42.5
Red Scale/*Pseudhomalopoda*	15	7.4	9.0	4.2	5.2	13.0	1.8
Chaff Scale/Parasites	14	15.1	7.1	8.1	4.0	16.5	4.2
Glover's Scale/*Prospaltella*	5	0.8	6.0	0.9	0.6	2.0	5.0
Yellow Scale/*Aphytis*	4	—	—	—	—	3.1	3.1
Purple Mites/*Entomophthora*	10	1.9	2.0	—	—	4.5	3.5
Six-spotted Mites/*Typhlodromus*	9	—	—	1.9	1.4	1.0	0.7
Brevipalpus/*Typhlodromus*	6	19.5	40.6	—	—	—	—

consistent. This tendency toward lower populations in under cultivated plots has been observed but not reported by other workers.

No correlations could be demonstrated for *Entomophthora,* the common fungus disease, and citrus red mite population levels (Table 3).

Texas Citrus Mite, Eutetranychus banksi (McG.).—This mite occurred in the plots a total of seven grove years. Mean population data, shown in Table 2, indicate lower populations in over cultivated plots. However, yearly populations and means for each grove were inconsistent and therefore results were inconclusive.

Six-spotted Mite, Eotetranychus sexmaculatus (Riley).—This spider mite occurred in the Weirsdale and Palm Harbor groves a total of eight grove years. Lower populations occurred in the under cultivated plots every year. Table 2 gives the grove means for the test period.

Although no special counts were made on *Typhlodromus floridanus* Muma, the known mite predator, it is interesting to note that the overall populations of several species of typhlodromids were higher in the under cultivated plots in these two groves.

Citrus Flat Mite, Brevipalpus phoenecis (Geijskes).—Populations of this false-spider mite occurred during the entire experimental period only in the Fort Pierce grove. Table 2 shows that populations were lower in the over cultivated plot. The yearly means were lower in the over cultivated plot in five out of six years.

Analysis of predator data showed that certain species of typhlodromids were consistently higher in the over cultivated plots and to some extent were inversely related to flat mite populations on a year to year basis.

Summary and Conclusion

Six major injurious insects and mites, purple scale, Florida red scale, chaff scale, yellow scale, citrus red mite, and six-spotted mite, may be reduced in number or partially controlled by reducing cover crop cultivation to the minimum, consistent with good moisture conservation, fire protection, and efficient grove management. Exceptions to this generalization are the citrus rust mite which seems to be unaffected by cultivation practices, and Glover's scale and the citrus flat mite which may be more abundant under such conditions. Texas citrus mite populations were too low and inconsistent for evaluation.

Data on common and limiting predators, parasites, or diseases were inconclusive in many instances. On the other hand, incidence of chytridiosis in purple scale and *H. thompsonii* in citrus rust mite show that these two factors are strongly host density dependent, and specifically different typhlodromid populations were shown to be inversely proportionate to both six-spotted and citrus flat mite infestations. Hymenopterous parasites, in general, exhibited less dependence on host density in their relatively uniform rates of attack.

The general lack of a relationship between cultivation practices and abundance or rate of attack by natural control agents indicates that some as yet unknown factor governs the level of citrus insect and mite infestations under different cultural conditions. This factor may well be a "tree stimulation" as indicated by Osburn and Mathis (1944, 1946), but this

phenomenon was not observable on the mature trees utilized in these experiments.

LITERATURE CITED

Osburn, Max R., and *Willis Mathis.* 1944. Effect of cultural practices on the citrus rust mite. Jour. Econ. Ent. 37(6): 767.

Osburn, Max R., and *Willis Mathis.* 1946. Effect of cultivation on Florida red scale populations. 39(5): 571.

MYIASIS IN AN AQUATIC TURTLE.—A case of apparently accidental parasitism was recently found in a common snapping turtle, *Chelydra serpentina serpentina* (L.) involving the common drain fly, *Telmatoscopus albipunctatus* (Will.)[1].

Two young turtles, when bought at a reptile farm in Laplace, Louisiana, in September, 1960, were one or two months old (carapace length 33 mm.) and appeared to be in good health. They were brought to the laboratory at the University of Florida, Gainesville, and within two weeks fungal infections, concentrated on the head, lower jaw, and the neck region, were noted on one of the individuals. Several larvae were found when infected skin and areas adjacent to the infection were removed. The turtles were treated with liberal doses of gentian violet and the next day several more larvae were found. In all, 11 larvae were recovered from this turtle; however, the other turtle had no fungus infection and no larvae were found on or in its skin. The infected individual seemed to be in poor health and was, therefore, preserved and added to the collections of the University of Florida (UF 11692). Attempts to rear the larvae after they were removed from the turtle failed.

The larvae of this fly are not believed to be parasitic. Considering the nature of the infection, it seems probable that the sore on the neck of the turtle provided an attractive place for oviposition, which likely occurred in the laboratory. Such a ready adaptability to a parasitic situation may indicate that *T. albipunctatus* uses this method under natural situations as well. As aquatic reptiles are often infected with fungi, it is possible that myiatic infections of this type, though not reported, may occur frequently.—*Andrew A. Arata* and *Lewis Berner*, Department of Biology, University of Florida.

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[1] Dr. Alan Stone, Insect Identification and Parasite Introduction Research Branch, U.S.D.A., U. S. National Museum, kindly identified these specimens.

AN ANNOTATED LIST OF THE HORSE FLIES OF FLORIDA AND AN ILLUSTRATED KEY TO THE GENERA (DIPTERA: TABANIDAE)

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This paper summarizes, briefly, the nomenclatural status of horse flies from Florida. Following each name in the list of species are annotations relating to the papers published, since Philip's catalog (1947), which deal either directly or indirectly with Florida forms. If no annotations follow a species name, it means that no references subsequent to 1947 have been found in available literature, pertaining to that species. Full titles and sources are given in the bibliography. At the present time there are at least 120 names, exclusive of synonyms, applicable to the horse flies of Florida.

The generic key is designed to identify specimens of adult flies representing species known to occur in the State, and is a colligation and modification of keys published by Stone (1938), Fairchild (1942, 1950), Bequaert and Renjifo-Salcedo (1946), Philip (1941, 1947, 1954c, 1955), Steyskal (1953), and Philip and Fairchild (1956). Tribal and subfamilial separation of genera have been omitted for reasons of relevancy and brevity. Classificatory matters within the family are largely unsettled. Details of supraggeneric grouping are treated by Mackerras (1954, 1955a, 1955b). Specific names mentioned, refer to either the only species of a given genus known from Florida, or, to certain species within a given genus which have particular characteristics emphasized in the key.

Plates I & II are original, free hand drawings, meant to facilitate usage of the key. Stylets of female *Diachlorus ferrugatus*, figured in Plate II, represent the proboscidial elements common to the Brachycera and Nematocera. In this species, mandibles are boomerang-shaped with scalloped cutting-edge; galeae strong, their apical ⅓ serrate, and otherwise covered with scattered spiculi. Males in these suborders have the same kind of stylets as females, though they are thin, frail, without cutting edge, or otherwise reduced. Cyclorrhaphous flies, some of which are mistaken for horse flies by laymen, do not have mandibles.

NOMENCLATURE

The generic name *Agkistrocerus* Philip, 1941, transliterated from the Greek, would read *Ancistrocerus*. However, a change is not likely, and would result in preoccupation of the name by *Ancistrocerus* Wesmael, 1836, in the Hymenoptera.[2] The generic name *Aegialomyia* Philip, 1941, is treated here as a subgeneric name, with its species *psammophilus*, under *Stenotabanus* Lutz, 1913. *Haematopota* Meigen, 1803, is used as a counterpart generic name of *Chrysozona* Meigen, 1800, and *Chrysops* Meigen, 1803, a counterpart of *Chrysops* Meigen, 1800, following the report of Melville (1960).

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[1] Department of Entomology, University of Florida, Gainesville.

[2] Alan Stone, U. S. National Museum, *in litteris*, 15 Feb., 1961.

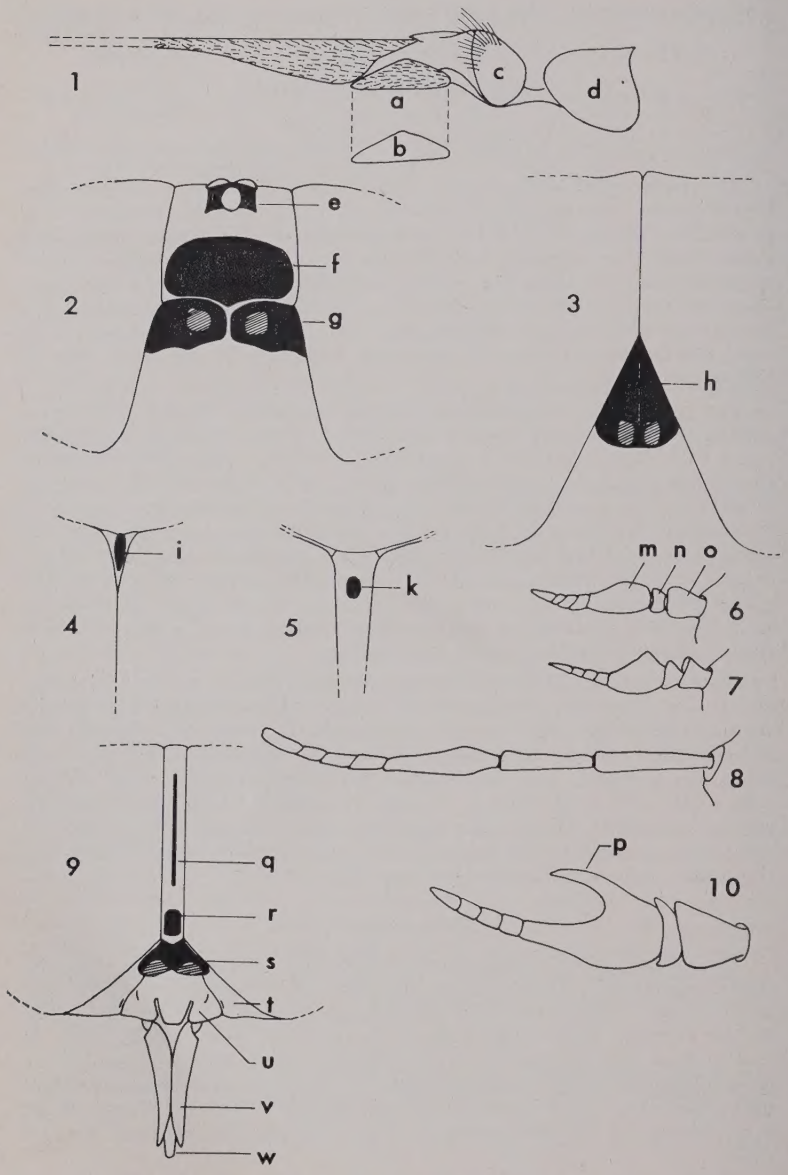

Plate I. Identifying characters in the horse flies.

Since Brennan's monograph (1935), the generic name *Chrysops* Meigen, 1803, has been used as a feminine noun. Some recent articles have treated it as a masculine noun. Because adjectival specific names must agree grammatically with the generic name, it is meaningful for the gender of *Chrysops* to be fixed, and the name used uniformly. Analysis of the word gives some criteria upon which an opinion may be based concerning the gender, but this is beyond the scope of the present paper. The stems, meaning, and genders of the adjective from which the noun form of the generic name is derived, lead to the choice of chrysops as the original form of the word and support the use of *Chrysops* Meigen, as a feminine noun. The rule-of-thumb that a compound noun derives its gender from the suffix used, is defended in the Copenhagen Decisions (1953).

Diagnosis of Tabanidae

Antenna with 3 obvious segments; the flagellum with 2 or more annulations, without arista or style; squamae large; empodium like the pulvilli; venation similar to Plate II, Figure 1, with veins R_4 and R_5 bounding the apex of the wing; males holoptic (except in the Australian genus *Archeomyia* Philip, 1941); females dichoptic; setitaxy not evident.

Plate I., Explanation

Figure 1. Right wing, frontal aspect, in *Agkistrocerus megerlei*, female specimen. (a) basicostal scale adjoining costal vein; (b) bare basicostal scale in another species; (c) epaulet, at base of wing; (d) notopleural lobe of mesothorax.

Figure 2. Head, frontal aspect, upper portion of face, in *Chrysops vittata floridana*, female specimen. (e) ocellar tubercle bearing ocelli; (f) basal callus; (g) subcallus, showing antennal socket.

Figure 3. Head, frontal aspect, upper portion of face, in *Chlorotabanus crepuscularis*, male specimen. (h) subcallus, showing antennal socket.

Figure 4. Head, dorsal aspect, in *Tabanus atratus*, male specimen. Vertical line represents intimate junction of the compound eyes. Horizontal arms represent hind border of compound eyes. (i) ocellar tubercle, without ocelli.

Figure 5. Head, dorsal aspect, in *Leucotabanus annulatus*, female specimen. Same as Fig. 4, but eyes are separated. (k) ocellar tubercle, without ocelli.

Figure 6. Left antenna, lateral aspect, in *Diachlorus ferrugatus* specimen. (m) flagellum, showing annulations on apical portion; (n) scape; (o) pedicel. These divisions correspond to segments 3, 2, 1, respectively.

Figure 7. Left antenna, lateral aspect, in *Chlorotabanus crepuscularis* specimen. Same division as in Fig. 6.

Figure 8. Left antenna, lateral aspect, in *Chrysops vittata floridana* specimen. Same divisions as in Fig. 6, but the segments are longer and narrower.

Figure 9. Head, frontal aspect, full face, in *Diachlorus ferrugatus*, female specimen. Eyes narrowly separated, ocellar tubercle not present. (q) median callus; (r) basal callus; (s) subcallus, showing antennal socket; (t) gena; (u) clypeus; (v) maxillary palpus; (w) labium.

Figure 10. Left antenna, lateral aspect, in *Agkistrocerus megerlei* specimen. Same divisions as in Fig. 6. (p) dorsal, forwardly directed hook on base of segment 3, the flagellum.

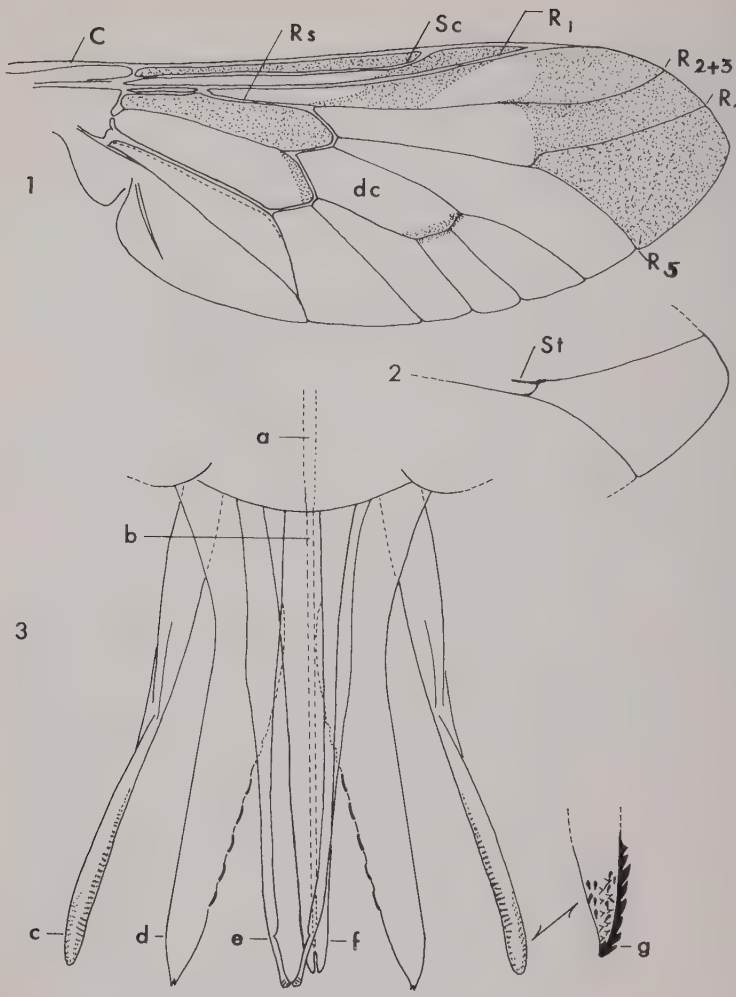

Plate II. Identifying characters in the horse flies.

Plate II., Explanation

Figure 1. Right wing, dorsal aspect, in *Diachlorus ferrugatus* specimen. Stippling represents smoky-colored areas. (C) base of costal vein; (Rs) radial sector, beginning basad of the discal cell; (Sc) subcostal vein; (R, 2 + 3, 4, 5) radial veins; (dc) discal cell. Posterior veins not numbered.

Figure 2. (St) stump vein present at base of R_1. Prominent in *Stenotabanus psammophilus*.

Figure 3. Stylets of the mouthparts of *Diachlorus ferrugatus*, female specimen, dorsal view, slide mount. (a) salivary duct, visible through clypeus; (b) salivary canal in hypopharynx; (c) right maxillary galea; (d) right mandible, with scalloped cutting edge; (e) labrum, showing central food canal; (f) hypopharynx; (g) enlarged tip of left galea, showing cuticular, saw-toothed edge.

ANNOTATED LIST OF HORSE FLIES KNOWN TO OCCUR IN FLORIDA

Agkistrocerus finitimus (Stone), 1938
Philip, 1954a. Note on holotype; description of female, pp. 31, 32
Philip, 1960a. Note on classification, p. 365.

Agkistrocerus megerlei (Wiedemann), 1828
Philip, 1960a. Note on classification, p. 365.

Anacimas geropogon Philip, 1936
Philip, 1952a. New record
Philip, 1954a. New record, p. 32.

Anacimas limbellatus Enderlein, 1923
Philip, 1952a. Plant-trapped.

Chlorotabanus crepuscularis (Bequaert), 1926
Philip and Fairchild, 1956. Keys & distribution.
Jones, 1953. Seasonal occurrence; larval habitat.
Anthony, 1960. Light-trapped.

Chrysops abata Philip, 1941
Philip, 1952a. Plant-trapped.

Chrysops amazon Daecke, 1905
Philip, 1955, p. 87.

Chrysops amazon hubbelli Philip, 1955
Philip, 1955. New subspecies, p. 88.

Chrysops atlantica Pechuman, 1949
Pechuman, 1949. New species, p. 79.

Chrysops beameri Brennan, 1935

Chrysops bistellata Daecke, 1905
Fairchild, 1950. Distribution, p. 10

Chrysops brimleyi Hine, 1904

Chrysops brunnea Hine, 1903

Chrysops callida Osten Sacken, 1875
Fairchild, 1950. Distribution, p. 10
Frost and Pechuman, 1958. Distribution, p. 180.

Chrysops cincticornis Walker, 1848
Synonym: *Chrysops celer* Osten Sacken, 1875
Philip, 1959, p. 201.

Chrysops cincticornis nigroptera Fairchild, 1937

Chrysops cursim Whitney, 1879

Chrysops dacne Philip, 1955
Philip, 1955. New species, p. 99.

Chrysops dimmocki Hine, 1905

Chrysops divisa Walker, 1848

Chrysops dorsovittata Hine, 1907

Chrysops flavida Wiedemann, 1821
Fairchild, 1950. Distribution, p. 12.
Philip, 1957. Southern extension in Antilles, pp. 15, 16.
Anthony, 1960. Light-trapped.

Chrysops flavida reicherti Fairchild, 1937
Anthony, 1960. Light-trapped.

Chrysops fuliginosa Wiedemann, 1821
Fairchild, 1950. Distribution, p. 12.
Philip, 1952a. Plant-trapped.

Chrysops fulvistigma Hine, 1904
Philip, 1950a. New record, p. 436.

Chrysops fulvistigma dorsopuncta Fairchild, 1937

Chrysops geminata Wiedemann, 1828

Chrysops hinei Daecke, 1907
Jones, 1953. Seasonal occurrence.

Chrysops moecha Osten Sacken, 1875
Philip, 1961 *in litteris* (Jan.), C. B. Philip to F. S. Blanton, Univ. Florida. New record. To be published subsequently.

Chrysops montana Osten Sacken, 1875
Fairchild, 1950. Distribution, p. 14.
Philip, 1955. Melanistic variations, p. 110.

Chrysops montana perplexa Philip, 1955
Philip, 1955. New subspecies, p. 111.
Anthony, 1960. Light-trapped.

Chrysops nigra Macquart, 1838
Philip, 1950a. New record, p. 436
Frost and Pechuman 1958. Distribution, p. 182.

Chrysops nigra taylori Philip, 1955
Philip, 1955. New subspecies, p. 112

Chrysops nigribimbo Whitney, 1879

Chrysops obsoleta Wiedemann, 1821

Synonyms: *Chrysops lugens* Wiedemann, 1821
Philip, 1950a, p. 431.
Fairchild, 1950. Distribution, pp. 13, 14.
Chrysops trinotata Macquart, 1838
Philip, 1955, p. 100.

Chrysops obsoleta lugens Wiedemann, 1821
Philip, 1955, p. 99.

Synonym: *Chrysops obsoleta ultima* Whitney, 1914
Philip, 1950a. New subspecies combination, p. 431.

Chrysops parvula Daecke, 1907

Chrysops pikei Whitney, 1904
Philip, 1950a. New record, p. 432.
Philip, 1961, *in litteris* (Jan.) C.B. Philip to F. S. Blanton, Univ. Florida. New record. To be published subsequently.

Chrysops pudica Osten Sacken, 1875
Jones, 1953. Seasonal occurrence.

Chrysops sackeni Hine, 1903

Chrysops univittata Macquart, 1855
Fairchild, 1950. Distribution, p. 15.
Frost and Pechuman, 1958. Distribution, p. 182.

Chrysops vittata Wiedemann, 1821
Fairchild, 1950. Distribution, p. 15.
Frost and Pechuman, 1958. Distribution, p. 182.

Chrysops vittata floridana Johnson, 1913
Jones, 1953. Seasonal occurrence.
Anthony, 1960. Light-trapped.

Chrysops wiedemanni Krober, 1926
Philip, 1950a. New record, p. 432.
McAlpine, 1960. Lectotype, p. 435.

Chrysops new species.
Philip, *in litteris* (Jan. 1961), C. B. Philip to F. S. Blanton, Univ. Florida. New species, to be described in Ent. News.

Diachlorus ferrugatus (Fabricius), 1805
Shewell, 1947. First male reported and described.
Fairchild, 1953a. New record for Mexico.
Anthony, 1957. Immature stages collected by soil treatment.
Blickle, 1958a. Eye color in male; males light-trapped.
Anthony, 1960. Females light-trapped.
Philip, 1960c. Lectotype, p. 174

Glaucops daedalus (Stone), 1938

Haematopota punctulata (Macquart), 1838
Philip, 1953. Key to Nearctic species of the genus, under *Chrysozona.*

Hamatabanus carolinensis (Macquart), 1838
Synonym: *Hamatabanus scitus* (Walker), 1848
Philip, 1950a, p. 433.
Philip, 1950b, p. 120.

Hamatabanus sexfasciatus (Stone), 1935

Hybomitra hinei (Johnson), 1904
Fairchild, 1950. Distribution, under *Tabanus.*

Hybomitra hinei wrighti (Whitney), 1915
Philip, 1950b. Neallotype male, p. 121.
Philip, 1952a. Plant-trapped.

Hybomitra lasiophthalma (Macquart), 1838
Synonym: *Hybomitra freta* (Stone), 1938
Philip, 1950a, pp. 433, 434.

Hybomitra trispila trispila (Wiedemann), 1828
Pechuman, 1960. Nominate subspecies compared with *H. trispila sodalis* Williston; distribution, p. 798.

Leucotabanus annulatus (Say), 1823
Jones, 1953. Larval habitat.
Fairchild, 1953b. Key to American species of the genus, pp. 274-276.
Anthony, 1960. Light-trapped.

Merycomyia brunnea Stone, 1953
Stone, 1953. New species, p. 256.

Merycomyia whitneyi (Johnson), 1904
Philip, 1954c. Distribution and key to species of the genus, p. 60.

Microtabanus pygmaeus (Williston), 1887

Stenotabanus floridensis (Hine), 1912
Stone, 1938. New combination, p. 34.
Synonym: *Tabanus floridensis* Hine, 1912
Stone, 1938, p. 34.
Philip, 1950a, p. 435

Stenotabanus psammophilus (Osten Sacken), 1876
Fairchild, 1951. Eye pattern compared to Panaman species.
Blickle, 1958b. Habits & immature stages.
Philip, 1958. Occurrence in Florida; keys to other species.

Tabanus aar Philip, 1941
Anthony, 1960. Light-trapped.

Tabanus abactor Philip, 1936
Schomberg and Howell, 1955. Biology.

Tabanus abdominalis Fabricius, 1805
Fairchild, 1950. Distribution, p. 20.
Synonym: *Tabanus limbatinervis* Macquart, 1847
Philip, 1959, p. 208 (Tasmanian species)

Tabanus acutus (Bigot), 1892

Tabanus americanus Forster, 1771
Bonhag, 1949, 1951. Anatomy of adults.
Fairchild, 1950. Distribution, p. 21.
Bromley, 1952. Biting habits.
Jones, 1953. Seasonal occurrence.
Anthony, 1960. Light-trapped.

Tabanus atratus Fabricius, 1775
Fairchild, 1950. Distribution, p. 21.
Philip, 1952a. Plant-trapped.
Jones, 1953. Seasonal occurrence.
Anthony, 1957. Immature stages collected by soil treatment.
Frost and Pechuman, 1958. Distribution, p. 184.
Anthony, 1960. Light-trapped.

Tabanus atratus fulvopilosus Johnson, 1919

Tabanus birdiei Whitney, 1914

Tabanus bishoppi Stone, 1933
Blickle, 1959. Hovering and mating habits.

Tabanus calens Linneaus, 1767
Synonym: *Tabanus giganteus* Degeer, 1776
Fairchild, 1950. Distribution, p. 24.
Philip, 1952b, p. 311.
Tashiro and Schwardt, 1953. Immatures; rearing.

Tabanus cayensis Fairchild, 1935

Tabanus cheliopterus Rondani, 1850

Tabanus cheliopterus subfronto Philip, 1936

Tabanus coarctatus Stone, 1935

Tabanus endymion Osten Sacken, 1878
Jones, 1953. Life cycle.

Tabanus equalis Hine, 1923
Philip, 1950a. New record, p. 436.
Schomberg and Howell, 1955. Biology.
Philip, 1959. New record, p. 215

Tabanus exilipalpis Stone, 1938

Tabanus fulvulus Wiedemann, 1828
Frost and Pechuman, 1958. Distribution, pp. 176, 178.

Tabanus fulvulus pallidescens Philip, 1936

Tabanus fumipennis Wiedemann, 1828
Jones, 1953. Seasonal occurrence; life cycle.
Anthony, 1957. Immature stages collected by soil treatment.
Anthony, 1960. Light-trapped.

Tabanus fuscicostatus Hine, 1906
Pechuman, 1949. New record, p. 83

Tabanus gladiator Stone, 1935
Anthony, 1957. Immature stages collected by soil treatment.
Anthony, 1960. Light-trapped.

Tabanus gracilis Wiedemann, 1828
Anthony, 1960. Light-trapped.

Tabanus imitans var. *imitans* Walker, 1848
Anthony, 1960. Light-trapped.
Philip, 1960b. Varieties of the species.

Tabanus imitans var. *excessus* Stone, 1938
Philip, 1954a. Allotype male, p. 26.
Pechuman, 1955. Redescription of male.
Anthony, 1957, 1960.
Philip, 1960b. Compared with other varieties of the species.

Tabanus imitans var. *pechumani* Philip, 1960
Philip, 1960b. New variety, p. 171.

Tabanus johnsoni Hine, 1907
Anthony, 1960. Light-trapped.

Tabanus kisliuki Stone, 1940
Philip, 1950a. New record, p. 436.

Tabanus lineola Fabricius, 1794
Fairchild, 1950. Distribution, p. 25.
Jones, 1953. Seasonal occurrence; larval habitat; pupal parasites.
Anthony, 1957, 1960.
Philip, 1957. Atypical specimens from Florida, p. 8.

Tabanus longiusculus Hine, 1907
Pechuman, 1958. Variations in specimens from Florida.

Tabanus melanocerus Wiedemann, 1828
Fairchild, 1950. Distribution, p. 25.
Anthony, 1960. Light-trapped.

Tabanus melanocerus lacustris Stone, 1935
Philip, 1950a. New subspecies combination, p. 435.

Tabanus molestus mixis Philip, 1950
Philip, 1950c. New subspecies, p. 241.

Tabanus mularis Stone, 1935

Tabanus nigrescens Palisot de Beauvois, 1809

Tabanus nigrescens atripennis Stone, 1935

Tabanus nigripes Wiedemann, 1821
Anthony, 1957, 1960.
Synonym: *Tabanus coffeatus* Macquart, 1847
Philip, 1950a, p. 434.
Philip, 1959, p. 206.

Tabanus nigrovittatus Macquart, 1847
Bailey, 1947a. Parasites of pupae.
Bailey, 1947b. Mating habits.
Fairchild, 1950. Distribution, p. 26.
Jones, 1953. Seasonal occurrence.
Synonym: *Tabanus vicarius* Walker, 1848 ex parte
Philip, 1960c, p. 174. Lectotype designated for *T. nigrovittatus.*

Tabanus nigrovittatus fulvilineis Philip, 1957
Philip, 1957. New subspecies, pp. 3-6.

Tabanus petiolatus Hine, 1917
Anthony, 1957. Immature stages collected by soil treatment.

Tabanus proximus Walker, 1848

Tabanus pumilus Macquart, 1838
Frost and Pechuman, 1958. Distribution, p. 185.
Anthony, 1960. Light-trapped.

Tabanus quinquevittatus Wiedemann, 1821
Fairchild, 1950. Distribution, p. 27.
Frost and Pechuman, 1958. Distribution, p. 184.
Synonym: *Tabanus manifestus* Walker, 1850
Philip, 1959, p. 209.

Tabanus quirinus Philip, 1950
Philip, 1950b. New species, p. 120.

Tabanus recedens Walker, 1848
Fairchild, 1950. Distribution, p. 27.

Tabanus rufofrater Walker, 1850
Jones, 1953. Life cycle.

Tabanus similis Macquart, 1849
Synonym: *Tabanus lineola* var. *scutellaris* Walker, 1850
Philip, 1959, p. 208.
Philip, 1960c, p. 174.

Tabanus sparus Whitney, 1879

Tabanus sparus milleri Whitney, 1914
Frost and Pechuman, 1958. Distribution, pp. 176, 178.

Tabanus stygius Say, 1823
Fairchild, 1950. Distribution, p. 28.
Anthony, 1957, 1960.

Tabanus sulcifrons Macquart, 1855
Bonhag, 1949, 1951. Anatomy of adults.
Tashiro and Schwardt, 1953. Larvae compared with *T. giganteus* (= *calens*)
Frost and Pechuman, 1958. Distribution, p. 183.
Anthony, 1960. Light-trapped.

Tabanus trijunctus Walker, 1854
Jones, 1953. Seasonal occurrence.

Tabanus trimaculatus Palisot de Beauvois, 1807
Fairchild, 1950. Distribution, p. 29.

Tabanus turbidus Wiedemann, 1828

Tabanus vittiger guatemalanus Hine, 1906
Fairchild and Aitken, 1960. Recorded from Trinidad, p. 7

Synonyms: *Tabanus lineola* var. *carneus* Bellardi, 1859
Tabanus lineola var. *scutellaris* Philip, 1949
Tabanus truquii Bequaert, 1940
Tabanus vittiger var. *bellardi* Szilady, 1926
Tabanus vittiger var. *caymanicus* Fairchild, 1942
Philip, 1954b, 1957, 1960a.
Pechuman, 1957.

Tabanus vittiger schwardti Philip, 1942
Philip, 1952a. Plant-trapped.

Tabanus wiedemanni Osten Sacken, 1876

Tabanus zythicolor Philip, 1936
Anthony, 1960. Light-trapped.

Whitneyomyia beatifica (Whitney), 1914

Whitneyomyia beatifica atricorpus Philip, 1950
Philip, 1950b. New subspecies, p. 122.

Key to Genera of Floridan Horse Flies

1. Wing completely and lightly dappled, gray to brown; ocelli absent ..... *Haematopota* Meigen, 1803
Species: *punctulata*

Wing not dappled 2

2. Ocelli well developed; vein Sc bare on upper and lower surfaces (Pl. I, Fig. 2; Pl. II, Fig. 1) 3

Ocelli either absent or inconspicuous; vein Sc hairy on lower surface, at least 4

3. Antenna conspicuously shorter than antero-posterior axis of head; basal segment at least as wide as long ..... *Merycomyia* Hine, 1912
Species: *brunnea, whitneyi*

Antenna conspicuously longer than antero-posterior axis of head; basal segment at least twice as long as wide

(Pl. I, Fig. 8) ..... *Chrysops* Meigen, 1803
Species: 40 or more, including varieties

4. Basicostal scale with hairs as densely distributed as those on adjoining costal vein (Pl. I, Fig. 1) 5

Basicostal scale either distinctly bare, or, with very few hairs, in a line or patch 8

5. Antenna with a conspicuous, dorsal, forwardly directed hook on the base of segment 3 (Pl. I, Fig. 10) 6

Antenna without hook on base of segment 3, though a dorsal process may be present 13

6. Eye sparsely to densely hairy[3] 7

Eye bare ..... *Tabanus* Linnaeus, 1758, ex parte
Species: *americanus, atratus, calens, fumipennis, imitans* var. *imitans, imitans* var. *pechumani*

7. Wing with isolated, smoky-colored patches; eye densely hairy ..... *Agkistrocerus* Philip, 1941
Species: *finitima, megerlei*

Wing clear; eye sparsely hairy ..... *Hamatabanus* Philip, 1941
Species: *carolinensis, sexfasciatus*

8. Antenna with 2-3 annulations in flagellum; few hairs on basicostal scale; small flies 9

Antenna with 4 annulations in flagellum 10

9. Antennal flagellum with 3 annulations, 2 of which are distinct; body blackish ..... *Microtabanus* Fairchild, 1938
Species: *pygmaeus*

Antennal flagellum with 3 indistinct annulations; body yellow-brown ..... *Glaucops* Szilady, 1923
Species: *daedalus*

10. Ocellar tubercle present; light, submedian pattern on abdominal tergites; basicostal scale with a few hairs (Pl. I, Fig. 4, 5) ..... *Stenotabanus* Lutz, 1913, ex parte
Species: *floridensis*

Ocellar tubercle not present; body color different 11

11. Thorax, abdomen, white; rubbed areas appear reddish-brown; legs yellowish-white; stump vein at base of R_4; basicostal scale with a few hairs (Pl. II, Fig. 2) *Stenotabanus* Lutz 1913, ex parte
Species: *psammophilus*

Body not white; basicostal scale bare (Pl. I, Fig. 1-B) 12

12. Body entirely pale yellow to green; proboscis moderately long; labellum small; stout flies ..... *Chlorotabanus* Lutz, 1909
Species: *crepuscularis*

---

[3] Minute hairs on disc of eye. Seen best when insect is tilted forward, the front edge of eye viewed against white, or sometimes black, background; magnified 10-60 X.

Body yellowish-brown; proboscis short; labellum large; mesocutum with distinct, greenish patch; apical ¼ -⅓ of wing between R_1 & R_5, smoky-colored (Pl. II, Fig. 1) *Diachlorus* Osten Sacken, 1876
Species: *ferrugatus*

13. Ocellar tubercle present (Pl. I, Fig. 4, 5) 14
Ocellar tubercle not present 15

14. Abdomen with sublateral-longitudinal pale areas, spots or triangles; a median dark stripe, on the tergites. *Hybomitra* Enderlein, 1922
Species: *hinei, hinei* var. *wrighti, lasiophthalma, trispila trispila*

Abdomen with pale, transverse, hind borders on the tergites: without longitudinal patterns ..... *Leucotabanus* Lutz, 1913
Species: *annulatus*

15. Clypeus, gena, subcallus, bare and swollen; eye bare; antennal flagellum without hairy annulations; wing dark brown; integument shiny black ..... *Whitneyomyia* Bequaert, 1933
Species: *beatifica, beatifica atricorpus*

Clypeus and gena sparsely to extensively hairy; characters in otherways different from those mentioned above 16

16. Palpus with long hairs on basal segments; proboscis slender; labellum small; antennal flagellum with short hairs on the annulations; gena with long, white hair .... *Anacimas* Enderlein, 1923
Species: *geropogon, limbellatus*

Palpus, proboscis, generally different from those described above; labellum large; antennal flagellum without hairy annulations ..... *Tabanus* Linnaeus, 1758, ex parte
Species: 58 or more, including varieties, and names in couplet 6.

Bibliography

Anthony, D. W. 1957. Pyrethrum emulsions for surveys of tabanid larvae. Jour. Econ. Ent. 50(6): 740-742.

Anthony, D. W. 1960. Tabanidae attracted to an ultraviolet light trap. Fla. Ent. 43(2): 77-80.

Bailey, N. S. 1947a. *Trichopria tabanivora* Fouts in Massachusetts (Hymenoptera: Diapriidae). Psyche 54(2): 142.

Bailey, N. S. 1947b. Field notes on *Tabanus nigrovittatus* Macquart. Psyche 54(1): 62-64.

Bequaert, J. C., and *S. Renjifo-Salcedo.* 1946. The Tabanidae of Colombia. Psyche 53: 52-88.

Blickle, R. L. 1958a. Eye color of male *Diachlorus ferrugatus* (Fabricius). Ent. News 69(9): 230.

Blickle, R. L. 1958b. Notes on *Aegialomyia psammophila* (O.S.). Fla. Ent. 41(3): 129-131.

Blickle, R. L. 1959. Observations on the hovering and mating of *Tabanus bishoppi* Stone. Ann. Ent. Soc. Amer. 52(2): 183-190.

Bonhag, P. F. 1949. The thoracic mechanism of the adult horse fly. Cornell Univ. Ag. Exp. Sta. Memoirs 285, 39 pp.

Bonhag, P. F. 1951. The skeleto-muscular mechanism of the head and abdomen of the adult horsefly. Trans. Amer. Ent. Soc. 77: 131-202, 31 figs.

Brennan, J. M. 1935. The Pangoniinae of nearctic America. Univ. Kans. Sc. Bull. 22(13): 249-401.

Bromley, S. W. 1952. Notes on Stamford bloodsucking flies. Ent. News 63: 97-100.

Fairchild, G. B. 1942. Notes on Tabanidae (Dipt.) from Panama. X. The genus *Tabanus* Linn., and resume of the Tabanidae of Panama. Ann. Ent. Soc. Amer. 35: 441-474.

Fairchild, G. B. 1950. Family Tabanidae. In: Guide to the insects of Connecticut. Part VI. The Diptera or true flies of Connecticut. State Geol. and Nat. Hist. Survey Bull. 75.

Fairchild, G. B. 1951. Descriptions and notes on neotropical Tabanidae. Ann. Ent. Soc. Amer. 44(3): 441-462.

Fairchild, G. B. 1953a. Tabanidae from the State of Chiapas, Mexico, with descriptions of two new species. Psyche 60(2): 41-51.

Fairchild, G. B. 1953b. Notes on neotropical Tabanidae with descriptions of new species. Ann. Ent. Soc. Amer. 46(2): 259-280.

Fairchild, G. B., and *T. H. G. Aitken,* 1960. Additions to the Tabanidae of Trinidad, B.W.I. Ann. Ent. Soc. Amer. 53(1): 1-8.

Frost, S. W., and *L. L. Pechuman.* 1958. The Tabanidae of Pennsylvania. Trans. Amer. Ent. Soc. 84: 169-215.

International Commission on Zoological Nomenclature. 1953. Copenhagen decisions on zoological nomenclature. Internat'l Trust Zool. Nomen. 135 pp. (49-51).

Jones, Calvin M. 1953. Biology of Tabanidae in Florida. Jour. Econ. Ent. 46(6): 1108-1109.

Mackerras, I. M. 1954. The classification and distribution of Tabanidae (Diptera). I. General Review. Aust. Jour. Zool. 2(3): 431-454.

Mackerras, I. M. 1955a. The classification and distribution of Tabanidae (Diptera). II. History: morphology: classification: subfamily Pangoniinae. Aust. Jour. Zool. 3(3): 439-511.

Mackerras, I. M. 1955b. The classification and distribution of Tabanidae (Diptera). III. Subfamilies Scepsidinae and Chrysopinae. Aust. Jour. Zool. 3(4): 583-633.

Melville, R. V. 1960. Report on Mr. C. W. Sabrosky's proposal for the suppression under the plenary powers of the pamphlet entitled "Nouvelle Classification des Mouches a Deux Ailes" by J. W. Meigen, 1800. Z.N. (S). 191. Bull. Zool. Nomen. 18(1): 9-64.

Pechuman, L. L. 1949. Some notes on Tabanidae and the description of two new *Chrysops.* Canad. Ent. 81: 77-84.

Pechuman, L. L. 1955. Some undescribed or little known males of Tabanidae. Bull. Brooklyn Ent. Soc. 50(3): 57-69.

Pechuman, L. L. 1957. A *Tabanus* not previously known from the United States. Ent. News 68(5): 118.

Pechuman, L. L. 1958. Some comments on *Tabanus longiusculus* Hine. Bull. Brooklyn Ent. Soc. 53(3): 74-75.

Pechuman, L. L. 1960. Some new and little known North American Tabanidae. Canad. Ent. 92: 793-799.

Philip, C. B. 1941. Comments on the supraspecific categories of nearctic Tabanidae (Diptera). Canad. Ent. 73: 2-14.

Philip, C. B. 1947. A catalog of the bloodsucking fly family Tabanidae (horse flies and deer flies) of the nearctic region north of Mexico. Amer. Mid. Natur. 37(2): 257-324.

Philip, C. B. 1950a. Corrections and addenda to a catalog of nearctic Tabanidae. Amer. Midl. Nat. 43(2): 430-437.

Philip, C. B. 1950b. New North American Tabanidae, Part II. Tabaninae. Ann. Ent. Soc. Amer. 43(1): 115-122.

Philip, C. B. 1950c. New North American Tabanidae, III. Notes on *Tabanus molestus* and related horseflies with a prominent single row of triangles on the abdomen. Ann. Ent. Soc. Amer. 43(2): 240-248.

Philip, C. B. 1952a. Notes on tabanid flies and other victims caught by the carnivorous plant *Sarracenia flava*. Fla. Ent. 35(4): 151-155.

Philip, C. B. 1952b. The Linnean and Degeerian species of American Tabanidae. Ann. Ent. Soc. Amer. 45(2): 310-314.

Philip, C. B. 1953. The genus *Chrysozona* Meigen in North America. Proc. Ent. Soc. Wash. 55(5): 247-251.

Philip, C. B. 1954a. New North American Tabanidae, VI. Description of Tabaninae and new distributional data. Ann. Ent. Soc. Amer. 47(1): 25-33.

Philip, C. B. 1954b. New North American Tabanidae, VII. Descriptions of Tabaninae from Mexico. Amer. Mus. Novit. 1695: 1-26.

Philip, C. B. 1954c. New North American Tabanidae, VIII. Notes on and keys to the genera and species of Pangoniinae exclusive of *Chrysops*. Rev. Brasil. Ent. 2: 13-60.

Philip, C. B. 1955. New North American Tabanidae, IX. Notes on and keys to the genus *Chrysops* Meigen. Rev. Brasil. Ent. 3: 47-127.

Philip, C. B., and *G. B. Fairchild.* 1956. American biting flies of the genera *Chlorotabanus* Lutz and *Cryptotylus* Lutz. Ann. Ent. Soc. Amer. 49(4): 313-324.

Philip, C. B. 1957. New records of Tabanidae in the Antilles. Amer. Mus. Novit. 1858: 1-16.

Philip, C. B. 1958. New records of Tabanidae in the Antilles, supplemental report. Amer. Mus. Novit. 1921: 1-7.

Philip, C. B. 1959. New North American Tabanidae, X. Notes on synonymy and description of a new species of *Chrysops*. Trans. Amer. Ent. Soc. 85: 193-217.

Philip, C. B. 1960a. New North American Tabanidae, XI. Supplemental notes pertinent to a catalog of Nearctic species. Ann. Ent. Soc. Amer. 53(3): 364-369.

Philip, C. B. 1960b. New North American Tabanidae, XII. A new variety of *Tabanus imitans* Walker. Fla. Ent. 43(4): 171-174.

Philip, C. B. 1960c. Supplemental note to Part X. Fla. Ent. 43(4): 174.

Schomberg, O., and *D. E. Howell.* 1955. Biological notes on *Tabanus abactor* Phil. and *equalis* Hine. Jour. Econ. Ent. 48(5): 618-619.

Shewell, G. E. 1947. The male of *Diachlorus ferrugatus* (Fabr.). Canad. Ent. 79: 32.

Steyskal, George C. 1953. A suggested classification of the lower brachycerous diptera. Ann. Ent. Soc. Amer. 46(2): 237-242.

Stone, Alan. 1938. The horse flies of the subfamily Tabaninae of the nearctic region. U.S.D.A. Misc. Publ. 305, 172 pp.

Stone, Alan. 1953. New tabanid flies of the tribe Merycomyiini. Jour. Wash. Acad. Sc. 43(8): 255-258.

Tashiro, H., and *H. H. Schwardt.* 1953. Notes on biology of *Tabanus giganteus.* Jour. Econ. Ent. 46(4): 681-682.

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EIGHT NEW *AMBLYSEIUS* FROM MEXICO WITH COLLECTION NOTES ON TWO OTHER SPECIES (ACARINA: PHYTOSEIIDAE)[1]

Donald De Leon
Erwin, Tennessee

Recent authors have not recognized *Amblyseiopsis* Garman and have placed mites of this group either in *Amblyseius* Berlese or in *Typhlodromus* Scheuten; although Garman (1958), considers *Amblyseiopsis* distinctive, I believe it is more correct to use the generic placement *Amblyseius*.

In the descriptions of new species all measurements are in microns and are averages unless variation from the average exceeds 10 per cent, in that case the range is given. Since D2-D6 and M1 in this genus are minute or nearly so (5-14 microns long) no measurements for these setae are given in the description of species. The females of all the species described have 4 pairs of interscutal setae.

Amblyseius megaporos, n. sp.
(Figures 1-3)

A. megaporos appears to be most closely related to *chiapensis*, described below, but differs most notably from that species in having the whip-like setae of the dorsal shield shorter and the pores of the ventrianal shield very much larger.

Female: Dorsal shield 355 long, 235 wide with setae of the following lengths: L1 53, L2 14, L3 11, L4 56, L5 11, L6 13, L7 11, L8 11, L9 195; D1 24; M2 56. VL1 65. Genital shield 92 wide at base; ventrianal shield 63 wide (74 wide at level of anus), 105 long, with three pairs of preanal setae and a pair of unusually large pores; primary metapodal shield 31 long about 5.4 wide, the anterior end constricted; accessory shield 18 long about 2 wide. Fixed digit with 10-11 teeth including the subapical tooth; movable digit not observable. Genua I-IV each with a macroseta 35, 39, 58, and 105 long respectively; tibia and metatarsus IV each with a macroseta 66 and 56 long respectively; tarsus IV 115 long, excluding pretarsus.

Male: Unknown.

Holotype: Female, Veracruz, Veracruz, January 1, 1957 (D. De Leon), from *Bumelia* sp.

Amblyseius chiapensis, n. sp.
(Figures 4-7)

A. chiapensis resembles *elongatus* Garman, but differs from that species in having 6 pairs of "D" setae whereas *elongatus* has 5 pairs.

Female: Dorsal shield 322-376 long, 208-232 wide (5 specimens), with setae of the following lengths: L1 54, L2 13-19, L3 8-14, L4 100, L5 8, L6 9, L7 6, L8 8, L9 214-235; D1 24-30, M2 117. VL1 76 long. Genital shield 83 wide at base; ventrianal shield 71-81 wide 116-132 long, with three

[1] Research aided by a grant from Sigma Xi-RESA Research fund.

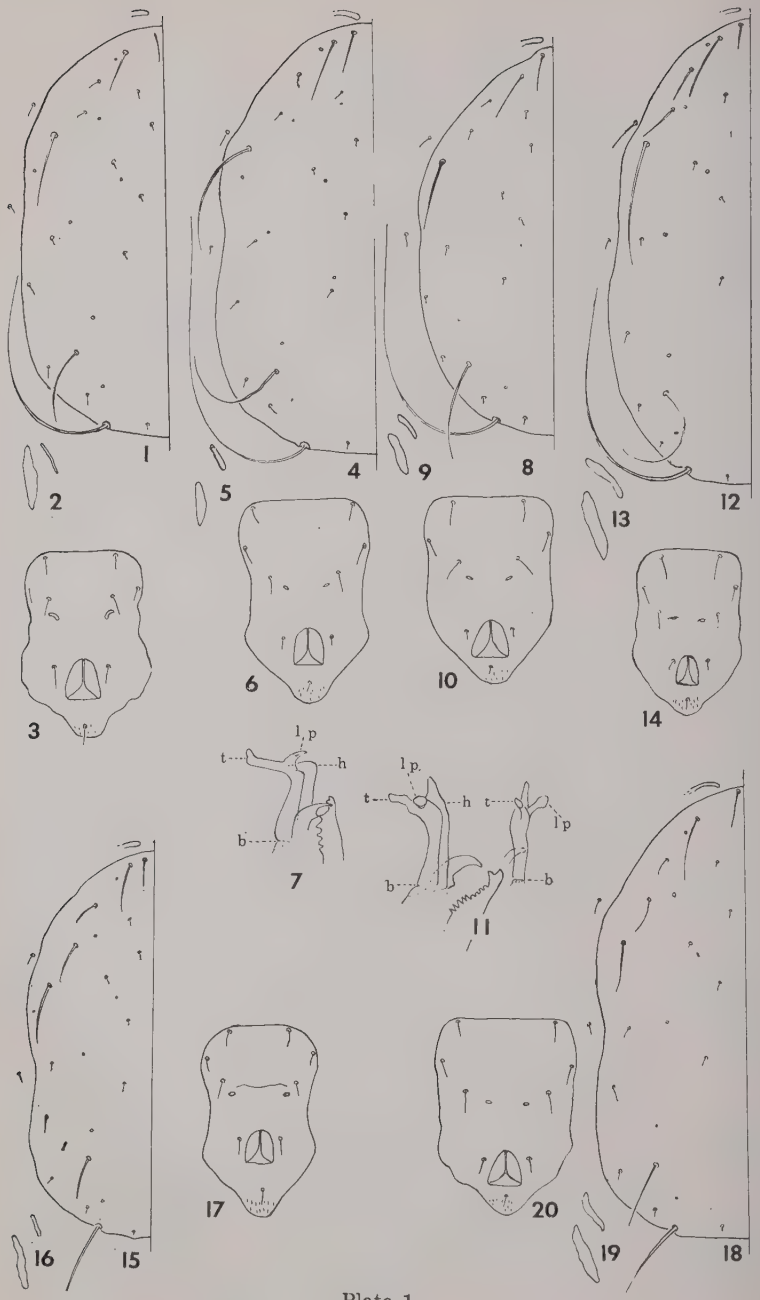

Plate 1

pairs of preanal setae and a pair of pores; primary metapodal shield 22 long, 5 wide; accessory shield 18 long, 3.5 wide. Fixed digit with 8-10 rather large teeth not including the subapical tooth; movable digit with 1 small tooth. Genua I-IV each with a macroseta 38-48, 38, 38-47, and 91 long respectively; tibia and metatarsus IV each with a macroseta 51-63, and 63-72 long respectively; tarsus IV, not including pretarsus 132-141 long.

MALE: Resembles female; dorsal shield 238-283 long, 163-180 wide (3 specimens). Ventrianal shield with 3 pairs of preanal setae and a pair of narrow pores. Spermatophore bearer with foot 12 long, shank 14 long, of shape shown in figure. The length of the shank is measured from its base to the distalmost point of the heel; in this species the heel is evenly rounded, but in the following species the distal part of the heel is prolonged. The length of the foot is measured from the tip of the toe to the back of the heel.

Holotype: Female, Tuxtla Gutierrez, Chiapas, January 18, 1957 (D. De Leon), from *Ceiba pentandra*. *Paratypes*: 2 males, 2 females, January 10, 1957, from *Acrocomia mexicana;* 1 male, 1 female, January 26, 1957, from *Cocos nucifera,* all other data as for holotype. Additional speimens were taken in the same area and during the same period from the following plants: *Styrax argentea, Annona purpurea, Sterculia apetala, Jaquinia pungens,* and *Quercus conspersa.*

Amblyseius coffeae, n. sp.
(Figures 8-11)

The female of *A. coffeae* closely resembles the female of *chiapensis.* L1, L4, L9, and M2 of *coffeae* are somewhat shorter and the pores of the ventrianal shield are somewhat more distant from the bases of the posterior pair of preanals than for *chiapensis;* the spermatophore bearer is distinctive.

FEMALE: Dorsal shield 344-365 long, 217-244 wide (5 specimens) with setae of the following lengths: L1 40-47, L2 12-14, L3 10, L4 70, L5 9-13, L6 11-14, L7 9, L8 9, L9 220; D1 30; M2 76-90. VL1 46-72 long. Genital shield 79-86 wide at base, ventrianal shield 74-85 wide, 112-127 long; primary

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Explanation of Figures

Figures 1-3. *Amblyseius megaporos,* n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

Figures 4-7. *Amblyseius chiapensis,* n. sp. Female, dorsal shield, metapodal shields, ventrianal shield; male, spermatophore bearer—b, base of shank; h, heel; l.p., lateral process, and t, toe. For details see discussion under description of this species.

Figures 8-11. *Amblyseius coffeae,* n. sp. Female, dorsal shield, metapodal shields, ventrianal shield; male, spermatophore bearer, lateral view (left) and edge view (right). Abbreviations as in figure 7.

Figures 12-14. *Amblyseius nayaritensis,* n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

Figures 15-17. *Amblyseius gliricidii,* n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

Figures 18-20. *Amblyseius arbuti,* n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

metapodal shield 25 long, about 6 wide, accessory shield 17 long, about 3 wide. Fixed digit with 10-11 teeth including the subapical tooth; movable digit with 2 teeth. Genua I-IV each with a macroseta 34, 36, 38-53, and 95 long respectively; tibia and metatarsus IV each with a macroseta 63-72 and 64-74 long respectively; tarsus IV, excluding pretarsus, 125 long.

MALE: Resembles female; dorsal shield 289-301 wide (2 specimens). Ventrianal shield with 3 pairs of preanals and a pair of pores. Spermatophore bearer with foot about 9 long, shank about 17 long, of shape shown in figures.

Holotype: Female, Cordoba, Ver., February 4, 1957 (D. De Leon), from orange leaves. *Paratypes*: 1 male, same data as for holotype; 1 female from coffee; 2 females from *Gilbertia arborea*, and 2 females from *Eriobotrya japonica*, all other data as for holotype. Additional specimens were taken from *Licaria coriacea* near Ocozocoatla, Chiapas, from an unknown host near Matias Romero, Oax., and from *Tillandsia* at Cordoba.

Amblyseius nayaritensis, n. sp.
(Figures 12-14)

A. nayaritensis resembles *A. andersoni* Chant, but differs from this species chiefly in having L3 about 3 times as long as L6 which is minute, in *andersoni* L3 and L6 are about equal in length, and in having L4 distinctly longer.

FEMALE: Dorsal shield 302-320 long, 180 wide (6 specimens) with setae of the following lengths: L1 29, L2 21-25, L3 22-32, L4 98, L5 7, L6 9, L7 9, L8 8, L9 155-190; D1 29; M2 91-101. VL1 63-75 long. Genital shield 74 wide at base; ventrianal shield 64-72 wide and slightly wider at at about level of anus with 3 pairs of preanal setae and a pair of narrow pores. Two pairs of metapodal shields, the primary 20 long about 5 wide, the accessory 14 long and about 2 wide. Fixed digit with 9-11 teeth including the subapical tooth, the 5 to 6 beginning with the second tooth from the base coarser than the others; movable digit with 3 small teeth. Genua I-IV each with a macroseta 29-38, 30, 34, and 74 long respectively; tibia and metatarsus IV each with a macroseta 51 and 74-96 long respectively. Tarsus IV, excluding pretarsus, 127 long.

MALE: Unknown.

Holotype: Female, San Blas, Nayarit, March 28, 1957 (D. De Leon), from *Casearia arguta*. *Paratypes*: 2 females from *Orbignya guacuyule* and 3 females from *Tetracera* sp. ? , Aticama, Nay., April 8, 1957; 1 female, San Blas, April 9, 1957, from *Annona* sp. The specimens from *Orbignya* were taken in association with *Tenuipalpus coyacus*.

Amblyseius gliricidii, n. sp.
(Figures 15-17)

A. gliricidii appears to be most closely related to *A. sinuatus*, n. sp., but is readily distinguished from that species in having setae M2 and L9 shorter and by the smaller and somewhat more elongate ventrianal shield.

FEMALE: Dorsal shield 338 long, 203 wide with setae of the following lengths: L1 51, L2 27, L3 39, L4 60, L5 12, L6 21, L7 13, L8 9, L9 70; D1

27; M2 44. VL1 51 long. Pores of the dorsal shield as for the previous species and with an additional refringent pore about midway between L6 and M2. Genital shield 81 wide at base; ventrianal shield 68 wide (very slightly narrower at level of anus), and 117 long with 3 pairs of preanal setae and a pair of narrow pores; 2 metapodal shields, the primary 29 long and about 3.7 wide, the accessory very narrow (full length not visible). Fixed digit with at least 7 teeth including the subapical tooth, movable digit with 2 teeth. Genua I-IV each with a macroseta 22, 26, 38, and 58 long respectively; tibia and metatarsus IV each with a macroseta 28 and 84 long respectively, the tip of the latter slightly enlarged; tarsus IV, excluding pretarsus, 136 long.

MALE: Unknown.

Holotype: Female, Tuxtla Gutierrez, Chiapas, January 18, 1957 (D. De Leon), from *Gliricidium sepium*.

Amblyseius arbuti, n. sp.
(Figures 18-20)

A. arbuti resembles *A. potentillae* Garman, but may be readily distinguished from that species in having the posterior margin of the sternal shield concave and in having the primary metapodal shield about 6 times as long as wide.

FEMALE: Dorsal shield 403 long, 251 wide (2 specimens), with setae of the following lengths: L1 47, L2 18, L3 30, L4 54, L5 11, L6 19, L7 11, L8 10, L9 84; D1 29; M2 66. VL1 56 long. Genital shield 100 wide near base; ventrianal shield 97 wide, 141 long with 3 pairs of preanal setae and a pair of narrow pores; 2 pairs of metapodal shields, the primary one 38 long and about 6 wide, the accessory 23 long and about 3 wide. Fixed digit with at least 11 teeth, excluding the subapical tooth; movable digit not observable. Genua I-IV each with a macroseta 36, 36, 36, and 60 long respectively; tibia IV and metatarsus each with a macroseta 50 and 93 long respectively; tarsus IV, excluding pretarsus 140 long. The setae of the legs and body unusually slender.

MALE: Unknown.

Holotype: Female, Quiroga, Michoacan, March 4, 1957 (D. De Leon), from *Arbutus* sp. *Paratype*: 1 female, other data as for holotype.

Amblyseius divisus, n. sp.
(Figures 21-23)

A. divisus resembles *A. potentillae* Garman, but differs from that species most noticeably in having the pair of pores of the ventrianal shield between and about in line with the bases of the third pair of preanals.

FEMALE: Dorsal shield 317 long, 208 wide with setae of the following lengths: L1 47, L2 12, L3 23, L4 65, L5 7, L6 9, L7 8, L8 8, L9 109; D1 27; M2 78. VL1 54 long. Genital shield 73 wide; ventrianal shield 83 wide, 110 long with 3 pairs of preanal setae and a pair of narrow pores; 2 pairs of metapodal shields, the primary one 19 long, 6 wide, the accessory 18 long 3 wide. Fixed digit with apparently 10 teeth including the subapical tooth; movable digit not observable. Genua I-IV each with a macroseta 26, 27,

31, and 60 long respectively; tibia and metatarsus IV each with a macroseta 46 and 72 long respectively; tarsus IV, excluding pretarsus, 127 long.

MALE: Unknown.

Holotype: Female, Matias Romero, Oax., January 30, 1957 (D. De Leon), from *Acrocomia* sp.

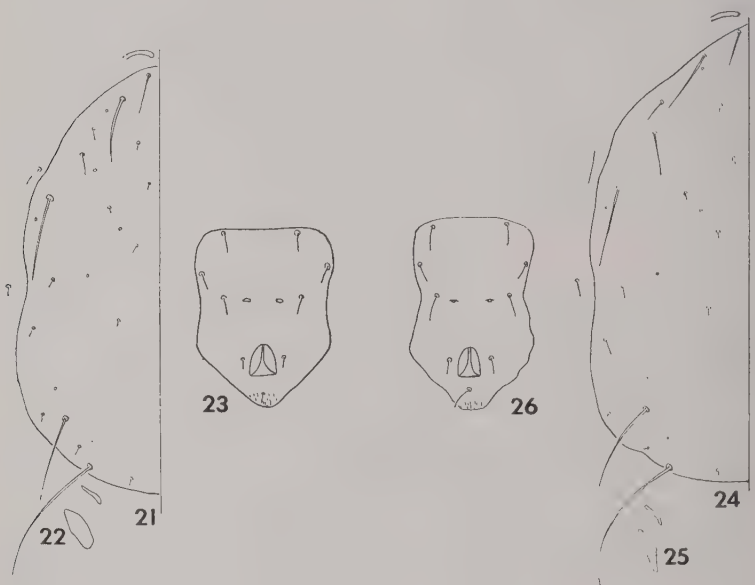

Plate 2

Explanation of Figures

Figures 21-23. *Amblyseius divisus*, n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

Figures 24-26. *Amblyseius sinuatus*, n. sp. Female, dorsal shield, metapodal shields, and ventrianal shield.

Amblyseius sinuatus, n. sp.
(Figures 24-26)

A. sinuatus resembles *divisus*, but is readily separated from that species in having L3 longer than D1 and L6 short, but not minute.

FEMALE: Dorsal shield 371 long, 217-226 wide (2 specimens) with setae of the following length: L1 56, L2 27, L3 46, L4 67, L5 9, L6 19-22, L7 8, L8 8, L9 108; D1 29; M2 70. VL1 66 long. Genital shield 83 wide; ventrianal shield 84 wide, 108 long with 3 pairs of preanals and a pair of narrow pores; 2 pairs of metapodal shields, the primary one 27 long, about 5.5 wide, the accessory 18 long and about 2 wide. Teeth of fixed digit small with 9, excluding subapical tooth, present; movable digit with 1 tooth. Genua I-IV each with a macroseta 31, 31, 31-36, and 63 long respectively; tibia and metatarsus IV each with a macroseta 47-57 and 78 long respective-

ly; tarsus IV, excluding pretarsus, 133 long. All leg setae more slender than usual.

MALE: Unknown.

Holotype: Female, Santa Maria del Oro, Nay., March 24, 1957 (D. De Leon), from *Hedyosmum mexicanum*. *Paratype*: 1 female, Tepic, Nay., from *Baccharus trinervis*.

Amblyseius limonicus Garman and McGregor, 1956

This distinctive species was collected at Veracruz from cherimoya; at Cordoba, Ver., from *Gilbertia arborea* and *Bursera simaruba;* at Jalapa, Ver., from *Inga* sp., and about 45 miles north of Oaxaca from a palm. The mite also occurs in the southeastern United States having been collected at Columbus, Ga., from *Hicoria* sp.; at Coral Gables, Fla., from *Exothea paniculata;* in the Everglades National Park from *Icacorea paniculata*, and at Key Largo, Fla., from *Pithecellobium guadalupense*.

Amblyseius largoensis (Muma), 1955

A. largoensis was collected at Veracruz, Ver., in December, 1956, from *mango* and from *Cocos nucifera*.

Paratypes of the above new species will be deposited in the University of Florida Collections, Gainesville; the remaining specimens are in the author's collection.

ACKNOWLEDGMENTS

I wish to thank the following botanists for the identification of plants: Mr. Miguel Angel Palacios Rincón, Instituto de Historica Natural de Chiapas, for those in the region round Tuxtla Gutierrez; Dr. Rogers McVaugh, University of Michigan, for those of Jalisco and Nayarit, and Dr. Faustino Miranda, Instituto de Biologia, Casa del Lago, Mexico, D. F., for those from other parts of Mexico.

LITERATURE CITED

Garman, P. 1958. New species belonging to the genera *Amblyseius* and Amblyseiopsis with keys to *Amblyseius, Amblyseiopsis,* and *Phytoseiulus.* Ent. Soc. Amer., Annals 51: 69-79.

Garman, P., and *E. A. McGregor.* 1956. Four new predaceous mites. So. Calif. Acad. Sci., Bul. 55 (Part I): 7-13.

Muma, M. H. 1955. Phytoseiidae (Acarina) associated with citrus in Florida. Ent. Soc. Amer., Annals. 48: 262-272.

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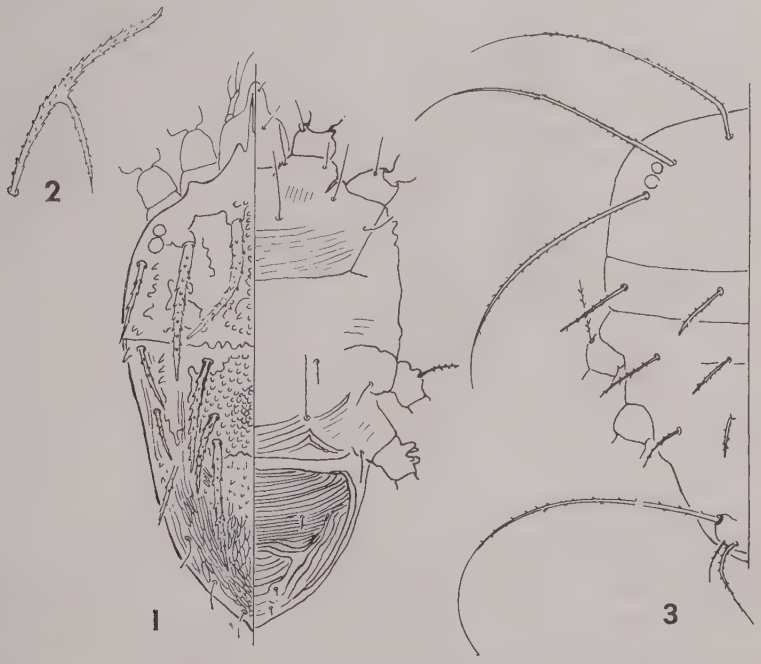
A NEW FALSE SPIDER MITE GENUS FROM MEXICO (ACARINA: TENUIPALPIDAE)[1]

Donald De Leon
Erwin, Tennessee

The false spider mites of Mexico have received little attention, yet preliminary studies show that some genera are common and widespread and are represented by many species. The new genus and species described below, however, was collected at only one locality.

Priscapalpus, new genus

Priscapalpus resembles *Brevipalpus* in dorsal chaetotaxy, but unlike *Brevipalpus* it bears an enlarged ventral plate and a rudimentary genital plate, the palpus is 2-segmented, and the legs are long in proportion to the length of the body.



Explanation of Figures

Figure 1, dorsum (left half) and venter (right half) of female *Priscapalpus macropilis*, n. sp.; figure 2, dorsocentral hysterosomal seta 1 of male, and figure 3, dorsum of deutonymph.

[1] This study has been aided by a grant from the Sigma Xi-RESA Research Fund.

Body narrowly oval; dorsum strongly ridged longitudinally, the ridge crested with tubercles, with 9 pairs of dorsolateral setae and 3 pairs of dorsocentral setae, all setae round or nearly round in cross section. Female with an enlarged ventral plate and a rudimentary genital plate, an anterior and a posterior pair of medioventral metapodosomals, a pair of medioventral opisthosomals, and 2 pairs of genital setae. Palpus 2-segmented, the distal segment with 3 setae. Legs rather long and slender, the fourth pair the longest, the 3 anterior pairs about equal in length; basal leg segments nobbed dorsad.

Type: *Priscapalpus macropilis*, n. sp.

Priscapalpus macropilis, n. sp.
(Figures 1-3)

FEMALE: Body white to pale yellowish; length including rostrum 273 microns, width 143 microns. Dorsum with markings and shapes of setae as shown in figure 1. Venter with characters of genus. Rostrum reaching slightly beyond middle of femur I, broad at base, the anterior third abruptly and narrowly constricted. Tarsi I and II each with 1 sensory rod, all claws with strong hooks; basal leg segments nobbed dorsad, nobs especially large on coxa III, dorsal setae of basal leg segments very coarse and scabrous; coxae III and IV without a ventral seta.

MALE: Resembles female, but dorsal setae somewhat shorter proportionally, dorsocentral 1 usually branched, and tarsus II with 2 sensory rods. Three anal setae present.

NYMPH: Dorsal setae arranged as shown in figure 3.

Holotype: Female, Puerto Vallarta, Jalisco, May 29, 1957 (D. De Leon), on the underside of leaves of "sapodilla". *Paratypes*: 4 females, 7 males, 1 nymph, other data as for holotype.

A paratype will be deposited in the University of Florida Collections, Gainesville; the remaining specimens are in the author's collection.

NOTICE

Plans for the annual meeting of the Florida Entomological Society are well along. We will meet jointly with the Entomological Society of America and the Southeastern Branch of E.S.A. in Miami from November 27-30. Headquarters for the National Society will be at the McAllister Hotel, those of the Florida Entomological Society and the Southeastern Branch will be at the adjacent Columbus Hotel. The Florida Society does not plan to hold paper-reading sessions at these meetings.—L. B.

ERYTHEMIS SIMPLICICOLLIS (SAY), A DRAGONFLY PREDATOR OF THE BOLLWORM MOTH [1]

R. Bell [2] and W. H. Whitcomb [3]

During the summers of 1959 and 1960, dragonflies were observed feeding on the bollworm moth, *Heliothis zea* (Boddie), near Pine Bluff, Hope, McGehee, Morrilton, Weiner, and Fayetteville, Arkansas. This study was done as a part of an investigation of the predators feeding on all stages of the bollworm. Extensive collecting of both predator and prey showed that in most cases the dragonflies preying on the bollworm moth belonged to one species, *Erythemis simplicicollis* (Say).

Dragonflies have been known as predators of the imago of various Lepidoptera for many years. Comstock (1879) reported that Mr. F. M. Meekin from Alachua County, Florida, had observed a dragonfly repeatedly feeding on the cotton leafworm moth, *Alabama argillacea* (Hbn.). In England, Poulton (1906) reported observations of dragonflies feeding on various prey, including a butterfly of the family Lycaenidae and one of the family Danaidae as well as a skipper of the family Hesperiidae. Lefroy (1910) reported lepidopterous remains in the excreta of Indian dragonflies. Another English entomologist, Campion (1914), reported dragonflies, both African and English, feeding on seven different families of Lepidoptera. Warren (1915), working in Hawaii, examined the stomach contents of two species of dragonflies. In the case of *Anax junius* (Drury), 24% of the prey species identified belonged to the order Lepidoptera; in the case of *Pantala flavescens* (Fabr.), approximately 19% of the prey belonged to this order. Shiraki (1917) reported seven different dragonflies feeding on the adult of the paddy borer, *Schoenobius incertulas* (Wlk.), in rice fields in Formosa. Hobby (1933) recorded both dragonflies and damselflies feeding on Lepidoptera. He completed a list of prey of various British dragonflies in which seven families of Lepidoptera were represented, including Noctuidae. He further made the statement that dragonflies had been observed with lepidopterous prey more often than in the case of any other British predatory insect. Aoyama (1939) named dragonflies as a natural enemy of the pyralid moth, *Nymphula vittalis* Bremer, in Korea. Price (1958) reported several North American Odonata preying on various adult Lepidoptera, including *Gomphus fraternus* (Say) on the nymphalid, *Phyciodes tharos* Drury; *Gomphus externus* Hagen on *Pieris rapae* (L.); *Dromogomphus spoliatus* (Hagen) on *Pieris rapae* (L.), *Colias philodica* Godt., and *Phyciodes tharos* Drury; and *Erythemis simplicicollis* (Say) feeding on *Phyciodes tharos* Drury.

In a cotton field at the Five Forks Place near Pine Bluff, Ark., on July 22, 1959, a dragonfly, intermediate in size, was seen to swoop down, pick a bollworm moth out of the air, and then alight on a nearby cotton plant. An unsuccessful attempt was made to catch the specimen. Two more observations were made this same week at the Word Place, also near Pine

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[1] Published with approval of Director of the Arkansas Agricultural Experiment Station.

[2] Former graduate student, University of Arkansas.

[3] Entomologist, Arkansas Agricultural Experiment Station.

Bluff, but still there were no captures. One week later, on July 30, six observations were made, and four of the dragonflies were caught with their victims. The dragonflies were identified as the "green jacket", *Erythemis simplicicollis* (Say), and the victims, as *Heliothis zea* (Boddie). Further observations were made during August, and predator and prey were captured. The preying of *E. simplicicollis* on *H. zea* was found to be extremely common, although no method has yet been devised for determining the prevalence of such activity nor of determining the actual dragonfly population. At times, almost every moth flushed from the cotton was captured before it could alight again. The action took place at various hours from nine in the morning until dark. The last observation in 1959 was made on September 2.

The first observation outside the Pine Bluff area of *E. simplicicollis* feeding on the bollworm moth was made near Morrilton, Ark., on August 21, 1959, in corn. The following week, this species was captured while feeding on bollworm moths in cotton fields near McGehee and Hope, Ark.

The first observation in 1960 was made near Pine Bluff in cotton, June 20, when a specimen of *E. simplicicollis* was taken with a bollworm moth between its mandibles. On June 24, *E. simplicicollis* was taken feeding on a bollworm moth in a red clover field near Fayetteville, Ark. Numerous observations were made during July and August near Pine Bluff and Hope. The last observation near Pine Bluff made during 1960 was on August 20. After this date, cabbage looper moths, *Trichoplusia ni* (Hbn.), were so numerous that *E. simplicicollis* was largely occupied in taking this moth. The last observation in the state in 1960 was made by G. Dowell near Weiner, Ark., on September 4.

E. simplicicollis fed on several other noctuids. In the Pine Bluff area the most abundant of these was the cabbage looper. Late in the season at Hope, *Alabama argillacea* (Hbn.) was also taken in numbers. Feeding was in no way confined to the Lepidoptera; at times prey consisted mostly of other insects. Feeding took place freely from 9 A.M. until nightfall.

E. simplicicollis is common in cotton fields throughout Arkansas, even though some of these plantings are some distance from water. They are observed flying up and down the rows or zigzagging across the fields. The junior author has observed them perched on a middle branch of a cotton plant as late as 10 P.M. They are present from early June until late September.

E. simplicicollis is found throughout most of the U. S. from Massachusetts to California, north into Canada, and south into Mexico according to Needham and Westfall (1955). Bick (1941) studied the life history of this dragonfly in Louisiana.

Four other dragonflies are especially abundant in Arkansas cotton fields, *Pachydiplax longipennis* (Burmeister), *Pantala hymenea* (Say), *Plathemis lydia* (Drury), and *Tramea lacerata* Hagen. They are observed flying between the rows of cotton as does *E. simplicicollis*, but none of them have been seen feeding on *H. zea* by the authors.

Only one observation was made of any other species of dragonfly feeding on *H. zea*. This occurred on July 20, 1960, on the Word Place near Pine Bluff, Ark. Even this could not be completely verified, since the dragonfly, *Anax junius* (Drury), had so completely destroyed the moth that final verification was difficult.

As a result of these observations, it is quite clear that *E. simplicicollis* commonly feeds on the adult of *H. zea* and is apparently of economic importance under Arkansas conditions, although methods for determining actual dragonfly populations have not yet been developed.

Literature Cited

Aoyama, T. 1939. Life-history of *Nymphula vittalis* Bremer in Korea. Rep. Jap. Ass. Adv. Sci. 14(2): 320-323.

Bick, G. H. 1941. Life-history of the dragonfly, *Erythemis simplicicollis* (Say). Ann. Ent. Soc. America 34: 215-230.

Campion, H. 1914. Some dragonflies and their prey. Ann. Mag. Nat. Hist. 13 (8 series): 495-504.

Comstock, J. H. 1879. Report upon cotton insects. U. S. Dept. Agric. Rpt. 1879.

Hobby, B. M. 1933. The prey of British dragonflies. Trans. Ent. Soc. S. Eng. 8(2): 65-76.

Lefroy, H. Maxwell. 1910. Entomological notes: What do dragonflies eat? Jour. Bombay Nat. Hist. Soc. 20: 236-238.

Needham, J. G., and *M. J. Westfall, Jr.* 1955. A manual of the dragonflies of North America (Anisoptera). Univ. of Calif. Press, Berkeley.

Poulton, E. B. 1906. Predaceous insects and their prey. Trans. Ent. Soc. London. 1906. Part III: 398-401.

Price, H. F. 1958. Additional notes on the dragonflies of northwestern Ohio. Ohio Jour. Sci. 58(1): 50-62.

Shiraki, T. 1917. Paddy borer, *Schoenobius incertellus* Wlk. Agric. Expt. Sta., Govt. of Formosa, Taihoku 1917: 1-256.

Warren, A. 1915. A study of the food habits of the Hawaiian dragonflies. Bull. College of Hawaii Publications 3: 3-45.

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A METHOD FOR COLLECTING AND PRESERVING SPIDER WEBS

JOHN E. PORTER[1] AND NANCY M. PORTER[2]

Several techniques have been advanced for the study of spider webs. Comstock in *The Spider Book*, as revised and edited by Gertsch (1948), proposes that webs be photographed. It is suggested that these pictures be taken in one of several different ways: (1) In the field under conditions of natural and often inadequate lighting; (2) From webs constructed by spiders brought into the controlled conditions of the laboratory; or (3) From field collected webs removed by cutting the supporting vegetation and carrying the support and all into the laboratory.

Crompton (1950) reports upon the many habits of spiders but there is no indication that his studies were conducted with other than webbing fashioned by the spider in the field or under laboratory conditions.

Borror and Delong (1957) suggest that webs be collected and preserved between two pieces of glass which are then taped together in the fashion of a lantern slide.

The fragile nature of a spider's web and the desirability to spend more time with it than can frequently be permitted under field conditions indicated the need for a means of preserving the webs. Bishop (1940), before the advent of aerosol packaged paints and varnishes, suggested the use of brushing lacquer, lacquer thinner and "gold size". These were applied to spider webs by means of household spray guns. Properly prepared webs were then taped to the background material (usually glass) behind which was mounted a black cloth. Various protective steps were described as necessary in framing the webs.

By utilizing aerosol preparations of white paint and also varnish, the authors have developed the following relatively simple and quick means of collecting and preserving spider webs.

TECHNIQUE FOR COLLECTING WEBS:

Once a desirable web is observed it is carefully and gently sprayed using an aerosol preparation of white paint. A clean glass plate of the needed size is then carefully pushed into the center of the web with the forward motion continuing until the foundation lines and guy-lines of the web are broken loose. There is a natural adhesive quality to webbing and this, with the addition of the still moist paint, makes the web adhere tightly to the glass. In this manner a large or small section of a web can be taken in the field with very little, if any distortion of its design. Numbers applied with a wax pencil to the underside of the glass can correspond with the number assigned to the associated spider, trapped items and such other data as may be desired.

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[1] Entomologist, U. S. Quarantine Station, Miami Beach, Florida, Division of Foreign Quarantine, PHS, U. S. Department of Health, Education and Welfare.

[2] As a result of my daughter Nancy's interest in spiders and a corresponding need to develop a science project in connection with her school activities credit should be given to her for the ideas herein set forth.

If numerous mounts are to be made, a box can be prepared to hold these slides in a fashion similar to the familiar microscope slide box. There is then less danger of glass breakage or web disturbance.

TECHNIQUE FOR THE PRESERVATION OF SPIDER WEB MOUNTS:

The slide-mounted webs taken during the course of field studies can be permanently preserved by applying an aerosol spray coating of varnish directly to the webbed surface of the slide. Care should be taken in this instance to not overspray or spray from too close a distance for it sometimes will make the paint (previously applied to the web) smear.

The suggested means of spider web preservation is at this time only practical for those webs constructed in one plane, it does not include the many other types of webs constructed involving more than one plane.

LITERATURE CITED

Bishop, M. B. 1940. A method for the preservation of spider webs for museum exhibits. Turtox News 18(5): 80-81.

Borror, D. J., and *D. M. Delong.* 1957. An introduction to the study of insects. Rhinehart and Co., New York.

Comstock, J. H., and *W. J. Gertsch.* 1948. The spider book. Comstock Pub. Co., Ithaca, N. Y.

Crompton, John. 1950. Life of the spider. Fontana Books, London.

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